COASTAL LAND CONSERVATION IN MARYLAND: TARGETING TOOLS AND TECHNIQUES FOR SEA LEVEL RISE ADAPTATION AND RESPONSE

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Abstract

In the Chesapeake Bay relative sea level rise is impacting coastal lands at twice the global average rate. Over the last century relative sea level has risen a foot in the Bay causing the loss of 13 barrier islands and continual shoreline retreat. Maryland must have a strategy for coastal land conservation in order to preserve distinct habitat, facilitate shoreline migration, and to reduce and abate storm surge events that cause erosion and salt water intrusion. Developing new criteria to target land acquisitions and conservation easements is critical. A case study was done in Dorchester County in order to begin developing appropriate adaptive criteria. Two different sea level rise scenarios were evaluated for the Chesapeake Bay; 0-2, and 2-5 feet. In Dorchester County the 2-5 foot rise scenario would result in the conversion of working agricultural lands to waterfront. The case study found that under sea level rise scenarios upland conservation is the most important feature for land conservation. The uplands provide opportunity to facilitate inland migration of wetlands, the practice of wetland restoration ecology, carbon sequestration, all of which can help buffer against storm surge events, erosion, and salt water intrusion, and provide new habitat values for those lost. The criteria developed for the case study provide data layers for GIS targeting that will be expanded to incorporate Maryland's coastal zone. Additional criteria will be developed and applied to Maryland's coastal zone as the project continues to find adaptive benefits of land conservation under sea level rise scenarios.

Parcel Scale Case Study

Parcel scale analysis for current coastal land conservation easements and acquisitions assesses the parcel's ability to support climate change adaptation.

Parcel Level Criteria:

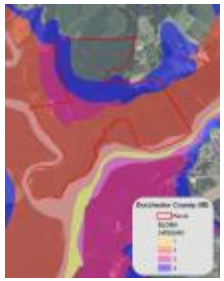
- Ability to buffer and/or provide resilience to population centers and/or other protected lands and State facilities from storm surge events
- Potential to serve as future community relocation area
- Mitigation opportunities
  - Removal of vulnerable hazards (septic systems, oil tanks, and animal feeding operations)
  - Carbon sequestration through afforestation or reforestation efforts
- Capacity of the property to provide a wetland habitat corridor
  - Elevation gradient
  - Intact coastal wetlands
  - Future sea level vulnerability
  - Presence of impervious barriers such as bulkheads, structures and roadways

Over the last century the Chesapeake Bay has seen a foot of relative sea level rise. This map shows the rates of sea level rise around the Chesapeake and Delaware Bays. Land subsidence along with sea level rise is exacerbating the rate of rise for this region.

Case Study Site

A parcel in Dorchester County bordered by Marshyhope Creek to the east and the Nanticoke River to the west. This property has a conservation easement.

Green Infrastructure includes Maryland's most important natural lands and the Blue Infrastructure includes the highest priority aquatic areas. Together these make up our current targeting matrix both at the statewide and parcel levels.



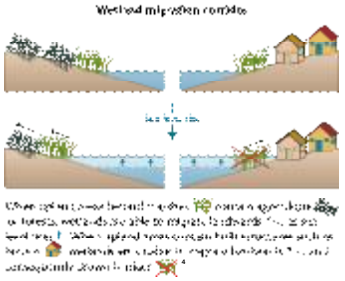
Storm surge is important to consider when looking at the long-term viability of a property. Storm frequency and severity is projected to increase with climate change. The SLOSH model for storm surge provides information on how a property might fair under hurricane conditions. From a land conservation standpoint it is important to consider how the conservation of a parcel may benefit surrounding areas by helping buffer community developments from storms.

Protected undeveloped lands provide many benefits to the surrounding area including storm surge buffers for local communities. Wetlands are natural storm surge buffers and provide habitat for important flora and fauna. This property has nearly 4-miles of intact shoreline with prime freshwater tidal wetlands.

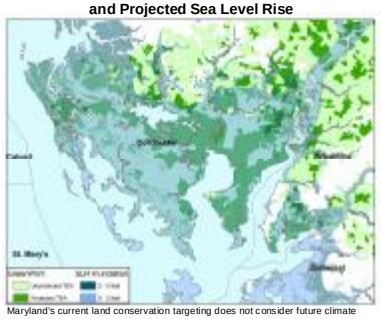
Sea level is expected to rise over the next century making it essential that we begin to proactively respond. One of the most important adaptation strategies is to facilitate and maintain functioning coastal wetlands, which includes planning for shoreline retreat.

Case Study Findings

Using the parcel-level climate change criteria the case study found that the property holds several important attributes for climate change adaptation. The property contains both Green and Blue Infrastructure making it ideal for ecological conservation. The storm surge model indicates that the parcel will likely withstand a category-4 storm. During a storm the property will help provide storm surge buffering for the communities of Galestown and Sharptown with its nearly 4-mile coastline of intact freshwater tidal wetlands. The property provides a positive inland elevation providing a wetland migration corridor that will enable the wetlands to roll back with retreating shorelines as sea level rises.



Current Targeted Ecological Areas and Projected Sea Level Rise



Maryland's current land conservation targeting does not consider future climate change conditions. Maryland's Climate Action Plan (2008) identified the need for an enhanced targeting framework that assesses climate change impacts and identifies adaptation opportunities.

Climate Change in Maryland

Anticipated Sea Level Rise in the Chesapeake Bay is between 1-1.3 feet in the next 50 years and 2.7-3.4 feet by the end of the century. Over the last century the Bay has seen a foot of rise due to the combination of land subsidence and sea level rise. Land subsidence is a result of land surface sinking and reducing elevation. In Maryland land subsidence is likely the result of several factors, the compression of surface sediment layers, deep layer compression from groundwater extraction, collapse of mantle forebulge with retreat of continental glacier, regional subsidence of a tectonic plate and continued depression of the continental margin by weight of sediment and seawater.[1]

In Dorchester County, Maryland estimates show that at the current rate of sea level rise (1 foot per century) will likely result in a 20% loss of its wetlands and 4.2% of its forests in the next 50 years.[2] Coastal wetlands provide key ecological functions such as storm surge buffers that provide community protection, waterfowl breeding areas, juvenile fish habitat, nutrient filtration, and much more. Using land conservation some of these important coastal wetlands may benefit from the creation of wetland migration corridors providing inland migration without barriers such as impervious surfaces, structures, hardened shorelines, etc.

References:
[1] Boesch, Donald F. (editor) 2008. *Comprehensive Assessment of climate change impacts in Maryland.* Report of the Scientific and Technical Working Group Maryland Commission on Climate Change.
[2] Carlisle, A., C. Conn, & S. Fabijanski. 2008. *Dorchester Inundation Study: Identifying natural resources vulnerable to sea level rise over the next 50 years?* Towson University Center for GIS, Towson, Maryland.
[3] Cole, Wanda. 2008. *Sea Level Rise. Technical Guidance for Dorchester County.* Maryland Eastern Shore Resource Conservation & Development County. Prepared for Maryland Department of Natural Resources Coastal Zone Management Division.
[4] Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/), University of Maryland Center for Environmental Science.

Maryland is highly susceptible to sea level rise inundation and storm surge events. Dorchester County on the eastern shore of Maryland is one of the most vulnerable counties in the Nation. The County has low-lying lands that have very little elevation change from shoreline inland.

Statewide Targeting at the Landscape Scale

Adaptation Benefits of Coastal Land Conservation: New landscape for land conservation includes Maryland's Green Infrastructure for the State's most ecologically important lands, Blue Infrastructure for near shore and aquatic hotspots, and climate change adaptation zones. Criteria for the statewide scale is continuing to be developed through case study analysis.

A berm has been installed on this property off of Wingate Bishops Head Road in Dorchester County to control tidewater. The combination of 5 inches of rain and a spring high tide resulted in house being surrounded by water. It is important to note that this is a non-storm related event for the County.[3]

Roadways in Dorchester County are becoming impassable during normal tidal events. This image is of Lakesville-Crapo Road in Dorchester County during a spring high tide event with a south wind.[3]

Criteria for Coastal Land Conservation in Response to Climate Change Impacts of Sea-Level Rise

- Landscape or regional characteristics that support climate change resilience
- Restoration potential and management considerations to enhance resilience to climate change
- Mitigation potential
- Sensitivity of lands to climate change impact at both spatial and temporal scale (sea-level inundation, shoreline erosion, and storm surge)

A. Blue and Green Infrastructure Priority
   i. Percent of property in the Green Infrastructure
   ii. Percent of shoreline in the Blue Infrastructure
B. Habitat Migration Opportunity
   i. Elevation
   ii. Intact coastal and upland wetlands
   iii. Sediment supply
C. Barriers to Habitat Migration
   i. Shore Protection
   ii. Bank Slope
   iii. Impervious Surfaces (roadways and structures)
   iv. Waterway obstructions
D. Mitigation/ Restoration Potential
   i. Carbon Sequestration through tree planting
   ii. Wetland and Shoreline Restoration
   iii. Removal of hazards (septic systems, poultry waste structures, gas & oil tanks)
E. Storm Surge Protection
   i. Proximity to State owned lands the property could help protect/buffer
   ii. Proximity to community developments the property could help protect/buffer
F. Environmental Hazards
   i. Does the property have a septic system?
   ii. Does the property have an existing or decommissioned oil tank?
   iii. Are there current or past animal feeding operations on the property?